DOCUMENT RESUME

ED 037 366 SE 008 203

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TITLE Analysis of Teaching Behavior, 1st Trial Edition.
INSTITUTION Texas Univ., Austin. Research and Development Center for Teacher Education.; Texas Univ., Austin. Science Education Center.
PUB DATE [70]
NOTE 53p.

EDRS PRICE EDRS Price MF-$0.25 HC-$2.75
DESCRIPTORS *Classroom Observation Techniques, Elementary School Science, *Elementary School Teachers, *Instructional Materials, Interaction Process Analysis, *Teacher Education, *Teaching Guides

ABSTRACT

The system of interaction analysis employed in this instructional module is "The Instrument for the Analysis of Science Teaching" (IAST), which has fourteen categories: eight for teacher talk, four for student talk, and two special categories. By using the IAST base, the indirect-direct climate of Flanders can still be considered; and, in addition, the types of teacher tactics employed and the kinds of behaviors exhibited by the students can be studied. Participants in this module receive training in using the IAST as a tool for self analysis of their teaching behavior. Training includes the introduction to, application of, and analysis of IAST in varying teaching situations. At the end of the module participants should be able to record and analyze the teaching behaviors actually employed in the classroom; they should also be more sensitive to the types of behaviors they wish to employ in an upcoming instructional period. The instructional component of this module is in the following sequence: Materials List, Pre-Module Low Ratio Teaching Assignment (pre-appraisal), Instructional Activities, Post-Module Low Ratio Teaching Assignment (post-appraisal), and Practice Sessions. The population for which this instructional program has been found to be effective includes preservice and inservice elementary school teachers. (BR)

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# ANALYSIS OF TEACHING BEHAVIOR

## 1st Trial Edition

The Research & Development Center
For Teacher Education

THE UNIVERSITY OF TEXAS
AUSTIN

SE 008 203

ED037366

MAR 27 1970

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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# ANALYSIS OF TEACHING BEHAVIOR

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# ANALYSIS OF TEACHING BEHAVIOR

Gene E. Hall

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and
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## I. PERFORMANCE OBJECTIVES:

At the end of this instructional sequence, the participants should be able to:

1. Name and describe the fourteen categories of the IAST system of interaction analysis.

2. Demonstrate the use of the IAST using a five-minute tape recording of classroom behavior.

3. Construct a matrix of the five-minute tape recording.

4. Construct the I/D ratio, i/d ratio, S/T ratio, and the percentages of tallies in each IAST category for the tape recording.

5. Describe and interpret the various parts of the matrix and ratios calculated.

After this instructional sequence, the participant should be aware of:

6. The IAST categories and sequence being used when planning for teaching and while teaching.

7. The IAST categories and sequence being used by another teacher.

8. The relative emphasis given to the different teacher categories.

9. The relative emphasis given to the different student categories.

## II. RATIONALE:

Much of what is taught to preservice teachers is not considered by them to be important or relevant, although empirical evidence may be

available demonstrating the importance of the information to their future success as teachers. In other words, at the time of its presentation, the information to be learned does not have meaning for the learner.

It seems reasonable to expect that for the most information to be learned, the sequence of information presentation should parallel what the learner considers to be important, of value, relevant, and meaningful at the time of presentation. For the preservice teacher, Fuller and her associates (1967) have identified six levels of concern that the preservice teacher passes through during his development.

After the participant has had first-hand experience in teaching, his early concerns such as "Where do I stand"? (Fuller, et.al., 1967) have probably been somewhat reduced. With this reduction in early concerns, a later concern that emerges is "How are they (the pupils) doing"? At this stage, the participant is less concerned with controlling the class and being liked by the students and more concerned with how effective his teaching is with respect to student learning. It is hypothesized that at this time the preservice teacher will have the "readiness" for considering the quantitative and qualitative analysis of his teaching behaviors.

One method for analyzing teaching behavior that has had frequent use is interaction analysis. Based on work by Withhall (1949), Flanders (1960) developed the original system of interaction analysis. The Flanders System in interaction analysis consists of ten categories: seven for teacher talk, two for student talk, and one for silence or confusion. The seven teacher talk categories are subdivided into indirect categories and direct categories. The emphasis of the Flanders System is on classroom climate; in other words, how direct or indirect the teacher is.

It has been suggested that preservice and inservice teachers who receive training in interaction analysis become more aware of their teaching behaviors than teachers who have not received this training. In addition, there is some evidence to suggest that interaction analysis training leads to the use of more indirect teaching behaviors. (See Amidon and Hough, 1967.)

Philip Jackson (1966) has identified two phases to the teaching act: the pre-active or deliberate phase, and the interactive phase. The pre-active phase entails the deliberate thought and formal planning given to the strategies and tactics to be employed in an instructional period, while the interactive phase entails on the firing line "snap" decisions as to the "best" tactics to be used in a given situation.

The system of interaction analysis to be employed in this module, The Instrument for the Analysis of Science Teaching, has fourteen categories: eight for teacher talk, four for student talk, and two special categories. By using the IAST base, the indirect-direct climate of Flanders can still be considered; and, in addition, the types of teacher tactics employed and the kinds of behaviors exhibited by the students can be studied.

The participants in this module will receive training in using the IAST base as a tool for self analysis of their teaching behavior. The training will entail the introduction to, application of, and analysis of the IAST base in varying teaching situations. At the end of this module, not only will the participant be able to record and analyze the teaching behaviors actually employed in the classroom (interactive) but, in addition the participants should be more sensitive to the types of behaviors they wish to employ in an upcoming instructional period (pre-active) and when on the firing line be able to make more effective "snap" decisions.

The population for which this instructional program has been found to be effective includes preservice and inservice elementary teachers who teach science.

The instructional activities of the module are based on this sequence:

| | | |
|---|---|---|
| Post-AT Assignment | Tape recorded - low ratio teaching | |
| Activity 5 | Interpreting Matrices | Develop skill in classifying behaviors that occur during consecutive three-second intervals using the IAST |
| Activity 4 | Meaning of Ratios<br>Construct Ratios | |
| | Practice Sessions | |
| Activity 3 | Describe Meaning of Matrix | |
| Activity 2 | Construct Matrix | |
| Activity 1 | Classify Tapescript Using the IAST<br>Describe Time Interval<br>Name and Describe the IAST Base Categories | |
| Pre-AT Assignment | Tape recorded - low ratio teaching | |

Evaluation Data:

Evaluation data is limited at this time to trial work with four groups of preservice elementary education majors. As a result of these tryouts, the following sequence and time intervals seem reasonable:

| | |
|---|---|
| Planning for Instruction | Approximately 3 hours |
| Teaching | 3½ to 5 hours |
| Pre-Appraisal | 5 minutes |
| Introduction and Activity 1 | 60 to 90 minutes |
| Activity 2 | 40 to 50 minutes |
| Activity 3 | 20 to 30 minutes |
| Activity 4 | 20 to 30 minutes |
| Activity 5 | 15 to 25 minutes |
| Practice Sessions | 10 to 15 minutes each |

In order to identify the present standing of the participants, the pre-appraisal is administered prior to presenting this module. By immediately having the participants score the pre-appraisal, it is then possible for the instructor to identify which sections of this module need heavier emphasis. Since later portions of this module will depend upon information developed by the participants in earlier activities of the module, it is impossible to skip activities. However, the relative time spent upon each activity can be varied depending upon the background experiences of the participants and their scoring on the pre-appraisal.

## III. REFERENCES:


Amidon, E. J. and Hough, J. B. Interaction Analysis: Theory, Research and Application, Addison-Wesley, Reading, Massachusetts, 1967.

Flanders, N. A. Interaction Analysis in the Classroom - A Manual for Observers. School of Education, The University of Michigan, Ann Arbor, Revised, 1963.

Fuller, F. F., Pilgrim, G. H., and Freeland, A. M. "Intensive Individualization of Teacher Preparation," from the Forty-Sixth Yearbook (1967) of the Association for Student Teaching entitled Mental Health and Teacher Education.

Jackson, P. W. "The Way Teaching Is," in The Way Teaching Is, Association for Supervision and Curriculum Development and the Center for the Study of Instruction of the National Education Association, 1967.

Withhall, J. "The Development of A Technique for the Measurement of Social-Emotional Climate in Classrooms," Journal of Experimental Education, 17, 1949, 347-361.

## IV. MATERIALS LIST:

| | |
|---|---|
| Pre-Appraisal | None |
| Introduction | None |
| Activity 1 | Handouts of the IAST base categories<br>$\pi$-1 tapescript<br>Transparency I - IASE base |
| Activity 2 | Handouts<br>$\pi$-1 tally record<br>Blank matrices<br>Transparencies II and III - blank matrices<br>Transparency IV - areas of matrix |
| Activity 3 | Transparency IV - areas of matrix<br>Transparency V - sample matrix<br>Transparency VI - $\pi$-1 matrix |
| Activity 4 | Transparency V - sample matrix |
| Activity 5 | Transparency VII - sample matrix<br>Transparency VIII - sample matrix<br>Transparency IX - sample matrix<br>Transparency X - sample matrix |
| Practice Sessions | Audiotape<br>Stopwatch |

Pre-Module Low Ratio Teaching Assignment:*

Prior to teaching this module, assign the participants to a low ratio teaching situation for which the objectives are supplied. The instructional procedure should be of the participant's own making. The lesson should be tape recorded on an audiotape; the audiotape will then be used as a part of the instruction for this module. If it is possible, the low ratio teaching situation should be to at least two children rather than peers and should be done just prior to beginning the Analysis of Teaching Behavior Module. At least ten minutes of audio recording should be made for each participant. (Refer to the handout included in the Duplicated Materials section of this module.)

Teaching Style of Module User:

You may wish to vary the pace depending on your class schedule. At any rate, intersperse the new information (activities) with practice sessions.

*From Using Space/Time Relationship 7 Symmetry, Science - A Process Approach, Part B, Xerox Education Division, New York.

It is okay to diverge or approach from a different direction; pace it according to the group. Try to be open and remain flexible. In place of suggested statements (in boxes) it is perfectly acceptable to ask expanded questions or substitute questions when necessary.

It is advisable for you to have learned the IAST categories prior to presenting this module.

Note: Students are apt to ask many questions of the type

"What do you call it when ----------?"

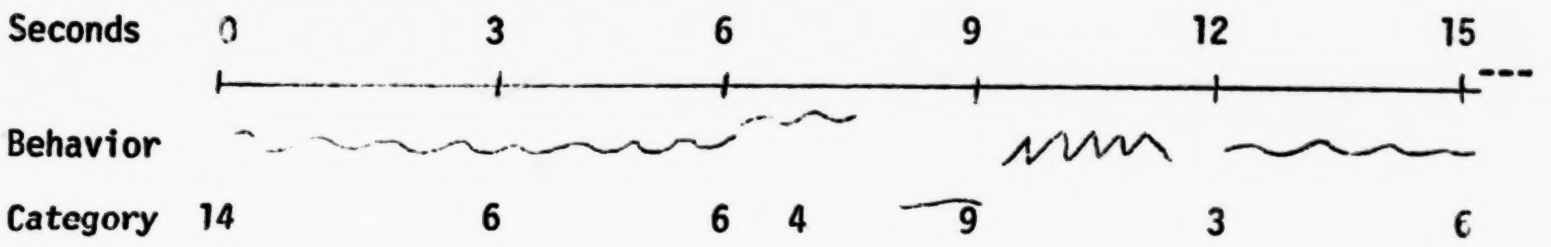
You may answer these questions in several ways:

1. Explain how the behavior will fit into an existing category;
2. Describe that ground rules might be established to cover this type of situation.
3. Describe a subcategory that could be used to distinguish the behaviors.

Teaching Hint

At various times it may be helpful to draw a time continuum on the board marking off three-second intervals and then using various wiggly lines to indicate the occurrence of various behaviors. Several purposes can be served here:

1. To indicate that various behaviors can occur within a given three-second interval;
2. That both behaviors should be classified;
3. In addition, it should be pointed out that you classify the behavior that has occurred during the three-second interval that has just passed; in other words, the numeral would be written at the beginning of the next three-second interval for the behavior that had occurred during the three-second interval just completed.



## PRE-APPRAISAL

This pre-appraisal may be administered orally by having the students raise their hands in response to each question.

1. Have you ever had any training in the use of interaction analysis? Yes No

   If you answered "yes": a. What system (e.g. Flanders)?
   b. How long ago?

If more than 50 per cent of the class received training in the use of a system of interaction analysis within the past year, there is probably little sense in teaching this module. However, you can place it to a vote; if there appears to be interest, go ahead (the IAST base does have more categories than the Flanders System) using the module for review of the principles of interaction analysis and learning the IAST base categories.

V. INSTRUCTIONAL ACTIVITIES

Analysis of Teaching Behavior

## Introduction

When asking the following questions, allow plenty of time for participants' responses. Solicit and accept answers from several participants.

2. Do you talk very much when you teach?

   a) How much?

3. What percentage of your class time do you spend talking?

4. Do you think that this percentage would vary depending on the content area you were teaching? Why?

5. What about the same content area but on different days?

6. Okay. In general you are saying that the amount of talk varies on different days with different content. There has been some research on this point and the researchers have established what they call "The Rule of 2/3's."

Outline the Rule on the board as you say,

7. The Rule of 2/3's says that on the average for elementary school teachers or secondary school teachers of science, social studies, or mathematics, 2/3's of the class time is spent in talking; 2/3's of that time the teacher is talking, and 2/3's of the teacher's talk is direct (meaning that the teacher is telling or demonstrating rather than interacting with the pupils).

8. What kinds of things do you say when you teach?

   a) Do you ask questions or lecture?

Collect the kinds of talk suggested, writing them on the board.

9. What other kinds of behavior occur in your classroom?

   a) Do your students do or say anything?

During this discussion the students may explore their teaching behaviors, what the students do, what the classroom arrangement is like, etc. Write them on the board for further reference.

## Activity 1 (The IAST Base)

Objective 1: Name and describe the fourteen categories of the IAST system of interaction analysis.

10. Could you think of any way to measure the occurrence of these kinds of behaviors in your classroom?

Accept and explore all suggestions. If not suggested,

11. Could we classify the various behaviors using the categories listed on the board? (Yes) This would be one possibility.

12. I have here one category system that has been developed for classifying and measuring teaching behavior. Let's look at this system and see if our list of behaviors can be classified using this system.

Hand out copies of the IAST base category system.

Using Transparency I explore the various behaviors. Define each category and give some examples.

Category 1: This category entails accepting and recognizing feelings of the students; in other words, being empathetic with the students. The category would include joking, which is not at the expense of a student. It also includes such behaviors as, when it is said sincerely, "I know this is difficult but let's try it anyway." If done as a form of encouragement, this would also include the teacher touches or puts her hand on the shoulder or head of a child. It should be pointed out that this category usually occurs less than one per cent of the time; however, this kind of behavior is considered to be important.

Category 2: This category involves praise--"That's a good job, John." However, this would not include the use of "good" as a response to every student's statement. This would be a verbal habit and therefore would no longer have any meaning for a student.

Category 3: This category is a restatement and/or expansion of a student's statement which could be either verbal or written on the board.

Category 4: This category is self explanatory if a teacher asks a question which leads to or requires a student answer.

Category 5: The teacher gives directions. These directions will require immediate observable behavior by the student. Examples might be: "Take out your books," "Turn to page 35," "Close the door," "At this time begin constructing your graph," etc.

Category 6: This category involves similar behavior to what I am doing to you right now. In other words, I'm just spewing out information to you--not attempting to interact--just provide information.

Category 7: This category includes the teacher justifying her authority, "All right, we're not moving ahead until everyone is quiet and in their seats," or criticizing a student, "That's the stupidest answer I've ever heard." This category would also include a joke, at the expense of a particular student; in other words, this student is personally hurt because of the joke.

Category 8: This category involves teacher controlled silence which could be following a category 7 while you're waiting sixty seconds for the children to be quiet or could include teacher demonstration.

Category 9: This category would be when the student states something that is not in the form of a question, while Category 10 would be the student asking a question.

Category 11: This category involves an affective response. This can either be positive or negative: "Yes, it's time for recess," or "Oh, no, not spelling again."

Category 12: This category entails student activity. This could be writing in a workbook, reading silently or reading aloud or working with scientific apparatus, etc.

Category 13: This category is an important one in that this entails a mark to point out when one student talks directly to another student without going through the teacher. It should be noted, though, that this behavior must be while the rest of the class and the teacher are listening; in other words, it is part of the instruction, not just two students gossiping.

Category 14: This category is nonfunctional behavior or perhaps even chaos. This is behavior when no apparent instruction or learning is taking place.

Then point out any behaviors that the IAST has that students did not consider. Ask,

13. Do any of these behaviors occur when you are teaching?

14. Well, it appears that the IAST can be used <u>to</u> <u>classify</u> teaching behaviors?

15. What about the quantity of each type of behavior? How could we keep track of the number of times that each category occurs?

The students or you can suggest recording a check (✓) or hash mark (/) each time a certain behavior occurs. Accept this and demonstrate how the record would be kept. For example:

| Category | No. of Times Occur |
|---|---|
| 1 | 𝍸 / |
| 2 | 𝍸 𝍸 𝍸 // |
| 3 | / |

16. Can you think of another way to record the data?

17. Making hash marks will tell us the frequency of each category; how could we keep track of the sequence of categories?

Accept and explore any suggestions. If the students do not suggest writing a category numeral whenever a certain behavior occurs, then:

18. Another way that we could record the category numerals would be to write a numeral every time a behavior occurs. For example, if the teacher says, "I have something to show you today."

How would you classify that statement? (Category 6)

Write the numeral "6" on the board.

Have the students decide how to classify each statement as you read the following:

19. Teacher continues: "As I pass this around, I want each one of you to look inside." (5)

T: "What do you see in the pot?" (4)

Betty: "I see a plant of some sort beginning to grow through the dirt." (9)

20. T: "Does anyone else see anything?" (4)

George: "It is a bean plant." (9)

T: "That's right, it is a bean plant. (3) As you know, bean plants are grown in gardens." (6)

This last 6 is providing additional information.

Now you have the category sequence

6
5
4
9
4
9
3
6

written on the board.

This tally record not only tells you what occurred during a time interval but also the sequence of behaviors. Point to the tally record and explain how the sequence shows this. For example, the teacher asked a question (4) and a student answered (9) and the teacher repeated the student answer (3).

21. How would you classify the following?

Read this all the way through without stopping.

22. Teacher: "Bean plants begin their lives as seeds which are planted in soft, moist earth. After the bean seed is planted, the seed begins to grow. The embryo plant will break through the ground several days after planting. At first the baby bean plant has two leaves on a long stem; the leaves are called cotyledons."

The students will classify this as a category 6. Now the students may be concerned that writing just one numeral for the type of behavior that occurs does not tell you how long the behavior lasted. However, if this concern is not manifested, then:

23. Do you see any problem with this six?

a) Is there any difference between this 6 and the 6 we had earlier?
b) What about the length of the time the teacher was talking?

The teacher talked longer the second time.

24. Okay. Could we come up with a modification in the recording method so that the length of the behavior will also be recorded?

The participants may suggest classifying each sentence. If they do, accept and explain the procedure.

25. Are there any other ideas?

If the students do not suggest classifying the behaviors that occur during the short time intervals, you can suggest this; for example, write a category at the end of every three seconds for the behavior that occurred during that three-second interval.

Now hand out and describe the script of the $\pi$-1 tape.

26. Using the IAST base, classify the first minute of the tapescript. Write your categories in a one-minute column on a separate piece of paper.

Discuss the classification and any questions.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

Insert a Practice Session about here.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

Assignments:

1. Ask the class to classify the remaining minutes of the tape-script, writing the numerals in one-minute columns, in class or at home to be discussed next time.

2. For the next class period have the fourteen categories memorized.

## Activity 2 (Construction of Matrix)

Objective 3: Construct a matrix of the five-minute tape recording.

Hant out copies of the tally record for the five-minute tapescript.

27. Compare the tally record I am handing out to you with the one that you made from the tapescript.

28. As you have probably observed, this tally record begins and ends with a category 14. For now, just accept this as a rule and I will explain the reason later.

Answer any questions that may be raised by clarifying the category definition and referring to the tapescript. One hundred per cent agreement will not always be possible and it is not imperative. In order to get more agreement, you may suggest various ground rules, such as:

> To have a category 5 the directions must require immediate student behavior, not telling the students something they will be doing later in the class.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

Insert a Practice Session about here.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

### Matrix Construction

29. As you have already seen, by classifying the behaviors that occur you can study the sequence of behaviors. However, I imagine that you are wondering if that is all that is possible; and, of course, the answer is that more information than just the sequence of behaviors is obtainable.

    In order to explain to you the kinds of information that we can look at, we will need a tally record.

The following will involve more lecture than normal. However, sometimes lecture can be the most efficient method.

Write a tally sequence on the board making sure that varied category transitions are demonstrated. Then, using a blank 14 x 14 matrix transparency (Transparencies II and III)--

30. A great deal of information can be obtained from placing the observation data into a "matrix"--the matrix in this case being 14 x 14.

Hand out sample 14 x 14 matrices to each student and then proceed. Going one step at a time, demonstrate how the sequence of tallies is placed on the matrix.

31. As was noted earlier, all tally records should begin and end with a category 14.

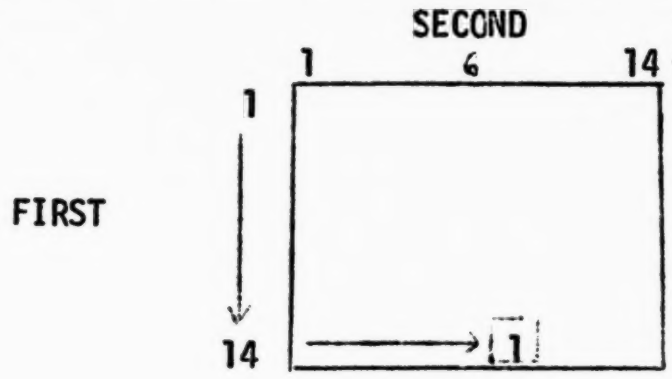
32. The first two categories that we have listed are what?

e.g. Category 14 going to a category 6. Link the 14-6 transition on the board with a curved line:

Step 1 (14
6
4
9

Point to and mark the matrix overlay in the 14-6 cell.

33. Each tally will be used twice. The tallies are recorded by moving down the left-hand column until the first category is found; in this case, category 14. Then move across the matrix until you intersect the cell of the second category; in this case, category 6. In that cell make a hash mark, indicating the transition 14-6.

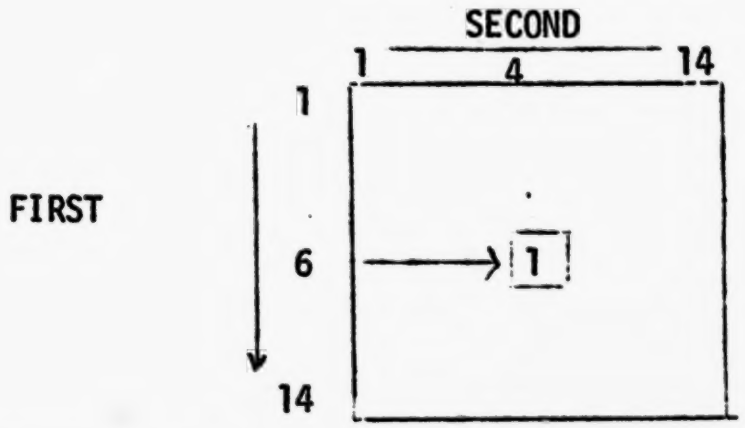


34. Next, the second category used; in this case, category 4 follows the category 6.

Point to the board and draw in the second curved line.

Step 1 (14
6)
4 Step 2

35. Here again the first category is found by moving down the left side of the matrix and then into the matrix for the second category.




36. Mark that cell, indicating a 6-4 transition.

37. This process is continued on until you get to the end of the tally record where the last transition will be to a category 14.

Step 1 (14 . )
6) .(
4) Step 2 . )
Step 3 (9 .(
3) Step 4 . )
Step 5 (6 .(
. . 14) Last Step
.
.

Answer any questions that the participants may have about matrix construction.

Using Transparency IV, describe the kinds of information that can be found when looking at the Teacher Talk block, Student Talk block, the Teacher Talk leading to the Student Talk block, and the Student Talk leading to the Teacher Talk block.

38. By looking at various areas of the matrix, the following kinds of information can be studied:

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

Insert a Practice Session about here.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

Assignment:

1. Prior to the next session the participants are to classify the audiotape from their pre-module low ratio teaching lesson using the IAST. The IAST tally record should then be used to construct a matrix of the lesson.

## Activity 3 (Matrix Interpretation)

Objective 5: Describe and interpret the various parts of the matrix and ratios calculated.

Display Transparency V.

39. From a matrix all sorts of interesting information can be obtained. What are some of the things that you can see?

The following sequence of concepts will probably take place in a different order each time this module is presented. However, based upon what participants see, proceed and insert the various ideas that are presented below:

40. One of the unique aspects of interaction analysis is that the sequence of the tallies is still preserved when they are placed in the matrix. As you remember, each tally was used twice in constructing the matrix. For example, if you wish to determine the number of times that a teacher question was followed by a student statement, i.e. the 4-9 transition, this information can be found by moving down the left-hand side of the matrix until you come to the category 4 row and following it across until it intersects the category 9 column. The number of tallies in this cell would be the number of times that the 4-9 transition occurred.

Here again this tally total could be converted to a percentage by dividing by the total number of tallies for that observation. This same procedure could be used for all of the cells of the matrix.

By pointing at one of the steady state cells, that is those cells that are on a diagonal from the upper left-hand corner to the lower right-hand corner, or those cells which indicate that a category is followed by itself, e.g. category 6 followed by category 6, ask the following question:

41. What kind of behavior would have occurred in order to have a tally in this cell?

Pointing to the 6-6 cell.

The participants will probably suggest that the category was repeated.

42. That's right; in other words, the teacher gave information for a period of time longer than three seconds. In other words, (write on the board) you had a 6 followed by a 6. These transitions of one category followed by the same category are called steady state cells or extended behavior cells.

Point to several other of the steady state cells asking what kinds of behavior would have been observed in order to have a tally in the cells.

43. What does it mean if we have a tally in the 4-4 cell?

The participants will probably suggest that you had a category 4 followed by a category 4. However, the participants are apt not to realize that this means that the question asked took longer than three seconds--in other words, the question was a six-second or a longer question. This point will probably have to be emphasized.

44. The other cells, those which are not steady state cells, are called transition cells--meaning that when a tally is made in one of these cells one category leads to a different category.

Continue a discussion of the matrix, pointing out various transition cells and how they can be linked together such as category 4 to 9 to 3 to 6 to 4 to 9 to 2 to 3 to 6, etc. explaining as you go what kinds of teacher-pupil behavior would be observed.

45. Where would you look to see what kind of behavior followed a 13?

Down to 13 and across to cells where there are tallies. These cells will be student categories.

46. What do these cells tell you?

Student response to student.

47. What behaviors lead to this response?

You want to look at the categories that lead to this response. Follow student categories across, and see which ones shift to 13.

Display the $\pi$-1 matrix (Transparency VI) asking the participants if they could predict which cells would have heavy loadings (6-6).

Answer any and all questions participants may have.

At this time discuss, as a class or individually with the participants, the interpretation of the matrices from their low ratio teaching; or, ask the participants in paragraph form to interpret their matrix before the next session. At the next session they would then turn in the paragraph interpretation and their matrix for your inspection.

## Activity 4 (Construction of Ratios)

Activity 4 probably should not be presented at the same time as Activity 3. Participant understanding seems to be clearer when the activities are presented at separate times.

Begin this activity with a review of how to construct a matrix and the kinds of information that can be obtained from a matrix as was presented in Activity 2.

Various questions should be asked by the instructor rather than a category 6 type of review. In addition, time should be spent on clarifying any participant questions.

48. a) Could someone tell us how to construct a matrix?
b) What kinds of information can we get from the matrix?
c) What would a large number of tallies in the ____cell tell us?

49. Okay. You have had some time to think over the matrix. Can you think of any other kinds of information we can get from it?

From here lead into a discussion of constructing ratios and their meaning. The order may vary depending upon the suggestions of the participants, or a straight forward teacher lecture may be employed to describe the ratios.

Using Transparency V--

50.

A. One of the things that is readily obvious is that from the matrix we can get the total number of tallies for each category.

Demonstrate this by running your pen across the overlay, pointing out how the column total and the row total for each category will be the same and present the total number of tallies for that category.

51. In addition, since we know the individual category totals we can also find the total number of tallies for a given observation period. From this information what else could we figure out?

Accept and explore any ideas that the participants present.

52. a) We could change the frequency of tallies for each category into percentages. By taking the total number of tallies for a category and dividing this by the total number of tallies for the observation, this could then be done for all fourteen categories.

B. The percentages for various categories could then be summed to give an indication of various kinds of behaviors.

53. Looking at our IAST categories, how do categories 1 through 4 differ from categories 5, 6, and 7?

Accept and explore all ideas suggested by the participants; in the end, it should be clear that categories 1 through 4 involve "indirect" teacher talk while categories 5, 6, and 7 involve "direct" teacher talk. By indirect we mean that these behaviors provide opportunity for the students to participate or to interact with the teacher, while the direct categories place more control with the teacher.

54. Could we compare the percentage of tallies in indirect categories with the percentage of tallies in direct categories?

a) How could we do this?

Here we are trying to get at the idea that the total number of tallies for categories 1 through 4 could be added together and divided by the total number of tallies for categories 5, 6, and 7 thereby giving you a ratio of the indirect behavior to the direct behavior, or "I/D ratio."

55. What would it mean if the I/D ratio were greater than 1?

This would mean that the teacher spent a greater proportion of time in indirect behaviors than she did in direct behaviors.

56. Okay, what would it mean if the ratio were equal to 1? (Less than 1?)

If the ratio were equal to 1, then this would mean that equal amounts of time were spent in indirect and direct categories; while if the ratio is less than 1, more time was spent in direct categories.

57.

C. What are some other ratios that could be constructed from this matrix?

Another ratio that should be suggested is that the teacher categories could be compared to the student categories; in other words, categories 1 through 7 compared to categories 9 and 10. The convention has been established that the student categories would be divided by the teacher categories--the ratio would be S/T categories 9 and 10 divided by categories 1 through 7.

58. What size would you expect this ratio to be in a normal class? In your class?

D. Another ratio to be examined is the revised I/D ratio. The revised I/D ratio or i/d ratio is an indication of how the teacher handles motivation and control behaviors. For this ratio the indirect categories 1, 2, and 3 are divided by categories 5 and 7.

59.

E. Okay, we've seen that various ratios can be calculated; we've also seen that the percentage of time spent in each category can be calculated.

## Activity 5 (Sample Matrices)

By asking various questions, lead the participants in understanding interpretation of the sample matrices. The following, in paragraph form, are some of the kinds of information that can be presented with respect to each of the transparencies. It is hoped that this will be taught in a discussion type form by asking questions such as:

What do you see in this lesson?

How did this lesson compare with the previous lesson?

Are the questions different here than in the previous lesson?

Was there teacher-lecture here?

Etc.

### Transparency VII

The outstanding feature of this class is teacher-lecture as indicated by the loading in the 6-6 cell. There are predominantly short teacher questions leading to student responses indicated by few tallies in the 4-4 cell and a heavy loading in the 4-9 cell. Teacher response to the students' statements came in the form of teacher restatement of the student statement (9-3 cell) and a new teacher question (9-4 cell). It also should be pointed out that long extended student statements (statements for a period longer than three seconds) are non-existent (no tallies in the 9-9 cell). The I/D ratio of 1.74 could be expected in terms of the great deal of time that was spent in the indirect behavior of asking questions. The revised i/d ratio of 2.24 also bears this out. However, it should be pointed out that the S/T ratio indicates that for every student's statement there were approximately three teacher statements or, for every three seconds of time spent in student categories, nine seconds were spent in teacher categories.

### Transparency VIII

This is different from the previous class in that teacher lecture (6-6) is missing altogether, although the behavior of short teacher questions followed by student statements again is present as indicated by the 4-9 transition. In this class, however, students' statements tended to be for longer periods than three seconds. This is indicated by the loading in the 9-9 cell. It also should be pointed out that teacher response to students' statements was varied with tallies in the 9-3, 9-4, and 9-5 cells. The I/D ratio of 2.6 is relatively high; the revised i/d ratio of .94

indicates that motivation control behaviors were half indirect and half direct. The Student Talk/Teacher Talk ratio is surprisingly high at .857, indicating that the student talked almost as much as the teacher talked.

Transparency IX

The predominant behavior demonstrated in this transparency is teacher-lecture (6-6 cell); the long teacher questions, as indicated by a heavy loading in the 4-4 cell, are followed by students' statements as indicated by tallies in the 4-9 cell. Students' statements tend to be longer than three seconds and teacher response to students' statements are almost without exception asking another question--i n other words, a typical question and answer cycle. What is also interesting about this transparency is the heavy loading in the 12-12 cell, which is student activity.

There are a couple of interpretations of this lesson, one being that it began with teacher lecture followed by a short question and answer period with the questions being relatively long, probably of the think type, and then student activity. Another interpretation would be that the class began with review question and answer sessions and then the teacher gave information and a few long directions, as indicated by tallies in the 5-5 cell, and then student activity. Another possibility would be that the teacher gave lecture information at the beginning, then gave some extended directions, then there was extended student activity, and then the teacher asked long questions for a review of the student activity. Examination of the tally record for this lesson would determine what the actual sequence was.

Transparency X

This transparency has the most variety of behavior of any of the four. There is some teacher lecture which is extended (6-6 cell); however, lecture tends to lead to teacher questions (6-4 cell). The loading in the 6-4 cell would indicate that the teacher lecture was probably for periods of around six seconds and this led to teacher questions so that the teacher was not lecturing for extended periods of time. Teacher questions led to student statements predominantly, although sometimes they led to category teacher controlled silence (4-8), indicating that the student was probably thinking before answering and the teacher gave time for this. Teacher response to students' statements is varied with tallies in the 9-2, 9-3, 9-4, 9-5, and 9-6 cells, as well as the 9-9 cell having many tallies indicating longer student statements. There is also heavy loading in the 12-12 cell indicating student activity. Overall, this matrix indicates that a wide variety of behaviors was employed.

Post-Module Low Ratio Teaching Assignment:*

Immediately following the presentation of the last activity of this module, the participants again should be asked to construct and teach a science lesson in a low ratio teaching situation. This lesson should be with at least two children and a ten-minute tape recording of their teaching should be made. The participants should then classify, using the IAST, their second lesson and construct a matrix and ratios. The participants can then compare their second lesson to their first lesson, identifying any areas where change occurred.

Caution the participants to make sure that the children they use for this assignment were not involved in the pre-module low ratio teaching assignment. (Refer to the handout included in the Duplicated Materials section of this module.)

*From Using Space/Time Relationship 7 Symmetry, Science - A Process Approach, Part B, Xerox Education Division, New York.

## Practice Session 1

Use beginning of audiotape.

1. Now let's try a one-minute interval of the audiotape in order to begin getting a feel for writing down the categories.

2. I will tap my pencil every three seconds and tell you when we get to one minute.

If there is an extra person (non-participant) handy, recruit him to act as official "tapper."

3. One method for keeping track of a three-second interval that you may find helpful is to tap your big toe. For example: Mark..two.. three..Mark..two..three..Mark..two..three.. All of you that remember the waltz can think about a slow motion waltz: 1..2..3..1..2..3..

Answer any questions.

4. Okay. Here we go. 3..2..1.. (start the tape)

Start the recorder; use a metronome or have someone tap a pencil every three seconds and stop after one minute. Write the categories on the board as the tape plays.

5. Okay, how did that feel?

6. Did everyone have approximately twenty 6's? In one minute you should have 18 to 22 tallies.

Pointing to your category sequence on the board. If time permits, classify and discuss other one-minute intervals from farther into the tape.

## Practice Session 2

1. Okay. Let's try another minute of the tape.

Review the categories that are likely to occur--3, 4, 6, and 9. Play one minute of the tape. After this minute and discussion, jump ahead to someplace in the third minute and do a minute there. Make sure to note the inch meter on the recorder before starting so that you can easily find the place again.

2. This time more categories will be used so you will have to listen a little more carefully.

Following the tape, the students will probably be talking amongst themselves about what happened.

3. This time several things happened. Let's see what it looks like.

Discuss the sequence of categories. It might be worthwhile replaying the tape naming the categories and pointing to the board as the tape plays.

Practice additional one-minute intervals.

4. Okay, that's enough of this now. Continue to think about your categories. Are there any questions?

## Practice Session 3+...

Additional practice sessions should follow the established format of playing a one-minute interval of the tape, recording tallies on the board while participants record tallies on their papers in one-minute columns. As the practice sessions go along, the participants should begin to get a feel for three-second intervals and the instructor should cease tapping every three seconds; perhaps informing them of when the 30-second mark is and when the one-minute mark is. The participants will begin to get 18 to 22 tallies per minute with practice.

As the participants become more skilled in classifying behavior, the audiotapes used should become more difficult, with more transitions and more categories being used. The number of practice sessions utilized would depend upon class time and participant interest. It is possible to assign additional classifying time on audiotapes outside of regular class.

# TRANSPARENCIES

IAST Base

TEACHER

1. Accept feelings
2. Praise
3. Acceptance of student's statements
4. Question
5. Direction
6. Provide substantive information
7. Criticizes or rejects student's ideas or behaviors
8. Teacher controlled silence

STUDENT

9. Student statements
10. Student questions
11. Affective response
12. Student activity
13. Division of student-to-student interaction
14. Nonfunctional behavior

Situation _____

I/D _____ i/d _____ S/T _____

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | |
| Tot | | | | | | | | | | | | | | | |
| % | | | | | | | | | | | | | | | |

Situation Areas IV

I/D ——— i/d ——— S/T ———

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | |
| 2 | | | Teacher | | | | | | Teacher | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| 4 | | Leading to | | | | | | | Leading | | | | | | |
| 5 | | | Teacher | | | | | | | to | | | | | |
| 6 | | | | | | | | | Student | | | | | | |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | |
| 10 | | Teacher Response | | | | | | | Continued | | | | | | |
| 11 | | | to Student | | | | | | Student | | | | | | |
| 12 | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | |
| Tot | | | | | | | | | | | | | | | |
| % | | | | | | | | | | | | | | | |

———

Situation low ratio teaching

V

$I/D$ $\frac{99}{54} = 1.83$ $i/d$ $\frac{22}{17} = 1.29$ $S/T$ $\frac{92}{153} = 0.60$

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 4 | 1 | | | 1 | | 2 | | | | | 8 |
| 2 | 1 | | 1 | 2 | | 1 | | | | | | | | | 5 |
| 3 | | | | 6 | | 3 | | | | | | | | | 9 |
| 4 | 2 | 1 | 1 | 13 | 3 | 5 | | | 51 | 1 | | | | | 77 |
| 5 | 3 | | | 4 | 3 | 1 | | 4 | 1 | 1 | | | | | 17 |
| 6 | | | | 16 | 7 | 10 | | 2 | 2 | | | | | | 37 |
| 7 | | | | | | | | | | | | | | | |
| 8 | 1 | | | 4 | 1 | 5 | | 12 | | | | | | | 23 |
| 9 | 1 | 4 | 7 | 27 | 1 | 10 | | 4 | 32 | | | | | | 88 |
| 10 | | | | 1 | 1 | 2 | | | | | | | | | 4 |
| 11 | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | |
| Tot | 8 | 5 | 9 | 77 | 17 | 37 | | 23 | 88 | 4 | | | | | 268 |
| % | 3 | 2 | 3 | 29 | 6 | 14 | | 9 | 33 | 2 | | | | | |

Situation $\pi - 1$ VII

$I/D$ $\frac{8.7}{87} = 0.1$ $i/d$ 0.1 $S/T$ 0.03

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | 1 | | | 2 | | | | | | | | | 3 |
| 4 | | | | 3 | | 1 | | | 2 | | | | | | 6 |
| 5 | | | | | | | | | 1 | | | | | | 1 |
| 6 | | | | 3 | | 84 | | | | | | | | 1 | 88 |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | | 2 | | 1 | | | | | | | | | | 3 |
| 10 | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | |
| 14 | | | | | 1 | | | | | | | | | | 1 |
| Tot | | | 3 | 6 | 1 | 88 | | | 3 | | | | | 1 | 102 |
| % | | | 2.9 | 5.8 | 0.9 | 86 | | | 2.9 | | | | | 0.9 | |

VII

Situation Low Ratio Teaching

I/D $\frac{122}{70} = 1.74$ $\frac{I}{d} \frac{47}{21} = 2.24$ $S/T \frac{65}{192} = .34$

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 1 | | 1 | | | | | | | | | 2 |
| 2 | | | | III | II | IIII | | | | | | | | | 9 |
| 3 | | 𝍸 IIII | | 𝍸 𝍸 𝍸 | IIII | III | | | | II | I | II | | | 36 |
| 4 | | | | 𝍸 IIII | | III | | 𝍸 | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 | II | I | | | | 75 |
| 5 | | | | 𝍸 I | II | 𝍸 II | I | | | | | IIII | | | 20 |
| 6 | | | | 𝍸 𝍸 IIII | 𝍸 II | 𝍸 𝍸 𝍸 𝍸 II | | | | I | I | I | | | 49 |
| 7 | | | | | | I | | | | | | | | | 1 |
| 8 | | | | I | I | I | | | III | | | | | | 6 |
| 9 | | I | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 IIII | 𝍸 II 𝍸 𝍸 | III | I | | I | I | I | | | | | 59 |
| 10 | I | | I | III | | I | | | | | | | | | 6 |
| 11 | I | | | II | | | | | | | | | | | 3 |
| 12 | | | I | 𝍸 | I | | | | | | | | | | 7 |
| 13 | | | | | | | | | | | | | | | 0 |
| 14 | | | | | | | | | | | | | | | 0 |
| Tot | 2 | 9 | 36 | 75 | 20 | 49 | 1 | 6 | 59 | 6 | 3 | 7 | 0 | 0 | |
| % | .7 | 3.3 | 13.2 | 27.5 | 7.3 | 17.9 | .4 | 2.2 | 21.6 | 2.2 | 1.1 | 2.6 | 0 | 0 | |

Situation Low Ratio Teaching

VIII

$I/D \frac{(1+2+3+4)=56}{(5+6+7)=21} = 2.666$ $i/d \frac{(1+2+3)=16}{(5+7)=17} = .94$ $S/T \frac{(9+10)=66}{(1+2+3+4+5+6)=77} = .857$

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 1 | | | | | | | | | | | 1 |
| 2 | | | | 1 | | 1 | | 1 | | | | | | | 3 |
| 3 | | 11 | | 𝍸 | 111 | | | | 11 | | | | | | 12 |
| 4 | | | | 𝍸 | 111 | | | 11 | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 1111 | 1 | | | | | 45 |
| 5 | | | | 𝍸 1111 | 111 | | | | 𝍸 | | | | | | 17 |
| 6 | | | | 1 | 11 | 1 | | | | | | | | | 4 |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | 11 | 11 | | | | | | | | | | 4 |
| 9 | 1 | 1 | 𝍸 𝍸 111 | 𝍸 𝍸 𝍸 1 | 1111 | 1 | | 1 | 𝍸 𝍸 𝍸 𝍸 | | 1 | | | 1 | 61 |
| 10 | | | | | | | | | | | | | | | |
| 11 | | | 1 | 1 | | | | | | | | | | | 2 |
| 12 | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | |
| Tot | 1 | 3 | 12 | 41 | 17 | 4 | | 4 | 66 | | 2 | | | 1 | 150 |
| % | .006 | .02 | .08 | .27 | .11 | .027 | | .027 | .44 | | .02 | | | .006 | |

Situation Low Ratio Teaching

IX

$I/D \ \frac{87}{57} = 1.52$ $\quad i/d \ \frac{8}{14} = 0.57$ $\quad S/T \ \frac{160}{144} = 1.11$

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | |
| 2 | | 4 | | 3 | | | | | | | | | | | 7 |
| 3 | | | | | 1 | | | | | | | | | | 1 |
| 4 | | | | 23 | 2 | 1 | | | 12 | | | 6 | | | 79 |
| 5 | | | | | 10 | | | | | | | | | | 14 |
| 6 | | | | 7 | 1 | 13 | | | | | | | | | 43 |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | 3 | | 11 | | 4 | | | 10 | | | | | | 37 |
| 10 | | | 1 | | | | | | | 1 | | | | | 2 |
| 11 | | | | | | | | | | | | | | | |
| 12 | | 2 | | 5 | | 2 | | | 1 | 1 | | 30 | | | 121 |
| 13 | | | | | | | | | | | | 25 | | | |
| 14 | | | | | | | | | | | | | | | |
| Tot | | 9 | 1 | 79 | 14 | 42 | | | 37 | 2 | | 121 | | | 304 |
| % | | 2.6 | .3 | 26 | 4.6 | 13 | | | 12 | .6 | | 39 | | | |

X

Situation Low Ratio Teaching

I/D 127/58 i/d 35/26 S/T 123/185

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 1 | 1 | 1 | | | 1 | | | | | | 4 |
| 2 | | | II | 𝍸 1 | 1 | 1 | | | | | | | | | 10 |
| 3 | | III | | 𝍸 𝍸 II | II | III | | | 1 | | | | | | 21 |
| 4 | II | | 1 | 𝍸 𝍸 𝍸 II | IIII | 𝍸 | | 𝍸 𝍸 𝍸 | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 | | 1 | | | 92 |
| 5 | II | | | 𝍸 III | 𝍸 II | III | | 1 | II | 1 | | II | | | 26 |
| 6 | | | | 𝍸 𝍸 𝍸 | | 𝍸 𝍸 II | | | 𝍸 | | | | | | 32 |
| 7 | | | | | | | | | | | | | | | 0 |
| 8 | | | | 𝍸 III | 1 | II | | IIII | 𝍸 1 | | | | | | 21 |
| 9 | | 𝍸 II | 𝍸 𝍸 III | 𝍸 𝍸 𝍸 III | 𝍸 1 | 𝍸 | | II | 𝍸 III | | | 1 | | 1 | 72 |
| 10 | | | | 1 | | | | | | | | | | | 1 |
| 11 | | | | 1 | | | | | | | | | | | 1 |
| 12 | | | | | III | | | | | | | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 | | | 49 |
| 13 | | | | | | | | | | | | | | | 0 |
| 14 | | | | | 1 | | | | | | | | | | 1 |
| Tot | 4 | 10 | 21 | 92 | 26 | 32 | 0 | 22 | 71 | 1 | 1 | 49 | 0 | 1 | 330 |
| % | 1 | 3 | 6 | 28 | 8 | 10 | 0 | 7 | 21 | .3 | .3 | 15 | 0 | .3 | 99.9% |

DUPLICATED MATERIALS

Pre-Module

Low Ratio Teaching Assignment

You are to design a lesson based upon the following objectives. Then teach the lesson to at least two children. Any grade level (K-6) is fine. You should make plans to have the lesson tape recorded for later use.

The objectives are:

At the end of this exercise the child should be able to

1. IDENTIFY objects which have line or plane symmetry.

2. DEMONSTRATE the symmetry of objects by matching their parts.

3. STATE and DEMONSTRATE that some objects can be folded or cut in more than one way to produce matching halves.

Post-Module

Low Ratio Teaching Assignment

You are to again construct and teach a lesson to two elementary school children. You are free to change the design of the lesson as long as it is based upon the objectives. The lesson should again be tape recorded.

Make sure that the children you teach were not involved in the first low ratio teaching assignment.

The objectives for the lesson are:

At the end of this exercise the child should be able to

1. IDENTIFY objects which have line or plane symmetry.

2. DEMONSTRATE the symmetry of objects by matching their parts.

3. STATE and DEMONSTRATE that some objects can be folded or cut in more than one way to produce matching halves.

IAST Base

TEACHER

1. Accept feelings: Recognizes and identifies with feelings of students (empathetic), non-evaluative encouragement or joking positive affective response.

2. Praise: A positive value judgment.

3. Acceptance of student's statements: A restatement of the student's statement, either written on the board or verbal. This category would also include short, non-evaluative confirmation such as "okay," "all right."

4. Question: All questions which require a student response.

5. Direction: Giving directions and procedures; telling the students how to do something. This requires an immediate student response or behavior.

6. Initiate substantive information: Lecturing, giving facts, calculating, including writing new information on the board, rhetorical questions, and review information would be included in this category.

7. Justification of authority: Disciplinary action and criticism of a student's behavior would be included in this category.

8. Teacher controlled silence: Periods of silence which would include teacher demonstration, or the teacher lecturing, or a teacher examining her notes would be included under this category.

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STUDENT

9. Student statements: This would include all student statements that are not questions.

10. Student questions: Questions asked by the students of one another or of the teacher would be placed in this category.

11. Affective response: Student responses that reflect student emotions or feelings about a certain topic.

12. Student activity: This would include activity such as students working in workbooks, reading silently to themselves or working with scientific apparatus, etc.

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13. Division of student-to-student interaction: A mark for the separation between two students' interactions.

14. Nonfunctional behavior: Behavior without direction or purpose where no effective instruction is occurring.

Five Minutes IT-1 Tape

T: Okay, today our lesson will be about "PI." I am going to explain to you what PI is, and I think that I can best do that by telling you that PI, first of all, is a letter in the Greek alphabet. PI is a letter in the Greek alphabet, looks like this (writes on board). That's PI. This is the way you spell it (writes on board) just P·I. Now, you have to consider what PI is really, and that is what I'm going to tell you today. /30 sec. PI is really a ratio. Ratio: R A T I O (writes on the board, spelling aloud). PI is a ratio. PI is a relationship too. PI is a relationship between the diameter of a circle and a circle's circumference. And this is kind of hard to believe; but this relationship, and listen to this very carefully, this relationship is the same with every circle, /1 min. no matter how big the circle is and no matter how small the circle is. I'm going to show you this relationship I'm talking about. This is what happens. If we would measure the diameter of a circle, and we would put that down; and if then, we would measure the circumference (or the distance around the circle) and we would put that down, and we would divide; if we would divide /1'30" the diameter into the circumference, we would get PI. And you say well what it PI? PI is a number too. PI is 3.1416 and it doesn't come out even; this will never go into here an even number of times. It will keep on going out here. /2' So most mathematicians and most people in school, most of the teachers you will have after me, will round it off and they will say that PI is 3.14. 3.14 is the value of PI. Let's try to understand what I am telling you now. I am telling you that no matter how large the circle is and where you get the circle, if you take the circle and you measure the diameter, /2'30" and you put the diameter down, you measure the circumference or the distance

around you put that down and then you make a division problem for yourself and divide the diameter into the circumference you are going to get 3.1416 and so on. Of course, when you get this part exactly right back here, it will depend on whether you measured very carefully or not.

/3' Now I'm going to measure some circles for you today, and I'm going to prove to you that this is right; but I'm afraid that my measuring tape is not as accurate or as good as I would want it to be. Ah, this tape belongs to one of the girls, I forget just who; but this tape is measured--the smallest thing I could measure with this tape is what, Shandid, can you see?

/3'30"
S: A sixteenth.

T: Well, you better, ah, look a little bit more carefully.

S: An eighth.

T: An eighth! There are only eight divisions there, aren't there? Only eight, so the closest I can measure is an eighth. So I'm going to do what I can here and hope that I get fairly accurate with it. First of all, John, would you agree with me that the distance across here is about eight inches?

S: Yes.

/4' T: About eight inches. Of course, I can't measure it exactly. So my diameter then is eight inches. Our diameter is eight inches, and now I am going to measure the distance around. The distance around the whole circle; I'll just stretch the tape measure around here and try to come as close as I can, and ah, I'd say the answer here is about 25 and 1/8. 25 and 1/8.

/4'30" The circumference is 25 and 1/8. Now what must I do in order to get PI? I must, I'll tell you--I must divide the diameter into the circumference. I have to divide 8 inches into 25 and 1/8 inches. So I'm going to divide 8 into 25 point, and let's change the 1/8, let's change the 1/8 to a decimal.

Remember I told you that today I'd probably have a decimal equivalent chart on the board /5' and I said that it would probably be 16ths. I didn't realize that this tape measure wasn't going to measure sixteenths; I thought that it would.

IAST Base Tally Record of 77-1 Tapescript

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